Make: Compressed Air Rockets Kit

Written By: Rick Schertle

TOOLS:

- Adjustable wrench (1)
  aka Crescent wrench
- Bicycle pump (1)
  or use a separate tire pressure gauge
- Drill (1)
- Drill bits (1)
- File (1)
- Gloves (1)
- Pencil (1)
- Pliers (1)
  aka Channellocks
- Rubber Mallet (1)
- Safety glasses or goggles (1)
- Scissors (1)
- Screwdriver (1)
- Solder (1)

PARTS:

- Make Compressed Air Rockets Kit (1)
- Tape, duct (1)
  or similar reinforced tape, for launcher
- Tape, masking (1)
  or clear packing tape, for rockets
- Batteries (2)
- PVC glue (1)
  This usually comes in 2 parts: PVC primer and PVC cement.
- Tape, teflon (1)
  aka thread sealing tape
- Tape, electrical (1)
  or heat-shrink tubing
- Glue stick (1)
- Paper napkin (1)

- Soldering iron (1)
- Wire cutters and strippers (1)

SUMMARY

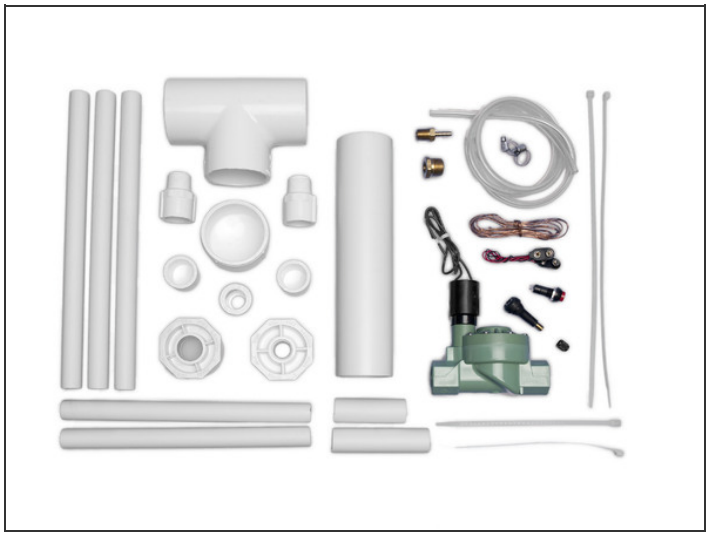
Building this rocket launcher is a breeze, and folks are always amazed at how it shoots reusable paper rockets 200–300 feet high.

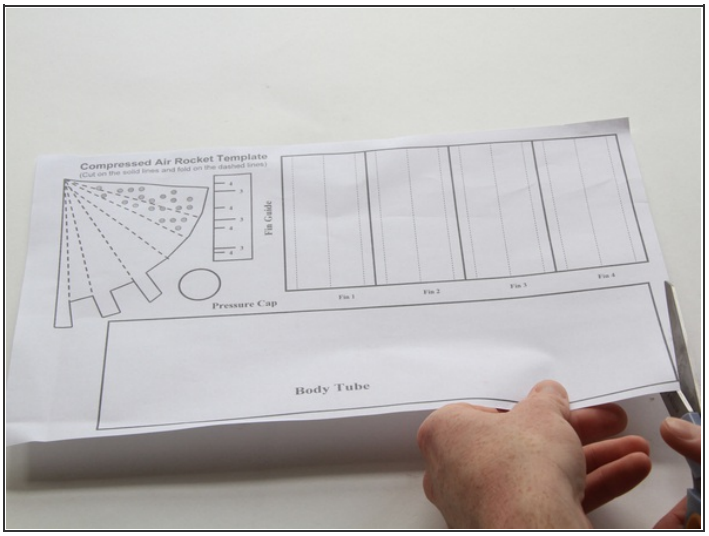
The launcher is made from PVC pipe. You pressurize its chamber to 75psi with about 18 strokes of a bicycle pump, then release all the pressure in a split second through an electric sprinkler valve, sending the paper-and-tape rocket into the sky.

Older kids can do the soldering, and adults should be on hand to supervise the launches, but younger kids can make the rockets and launch them too. It’s mind-blowing how high they go.

We recently revised the Make: Compressed Air Rockets Kit just in time for Maker Faire Bay Area 2012. So if you bought it in the Maker Shed store at Maker Faire, we thank you for your patience as we've put the full kit instructions online for the first time. Enjoy your kit!

Step 1 — Get to know the kit parts.





- Your kit contains: Pre-cut PVC pipe and fittings (17 pieces), 24V electric irrigation valve, brass reducer, hose barb, 4' air hose, 8' paired wires, momentary pushbutton, 9V battery snaps (2), hose clamps (2), tire valve, cable ties (4), rocket building guides (3), and rocket templates (10).
- Download extra rocket templates for free at makezine.com/go/rockettemplate.
- WARNING: CHOKING HAZARD — Small parts. Not for children under 3 years. Adult supervision recommended when using PVC cement.

Step 2 — Build the pressure chamber.



- Wrap teflon tape around the ½"×¼" brass bushing threads and screw it into the 2"×½" threaded PVC bushing, tightening with an adjustable wrench. Screw the hose barb into the brass bushing, and cement this assembly into one side of the 2" tee.
- TIP: To glue PVC connections, first wipe the contact surfaces with PVC primer, then wipe with glue, and twist the parts together to mate them, working quickly.
- CAUTION: Wear gloves and work in a well-ventilated area when gluing PVC.

Step 3 — Build the pressure chamber, cont'd.



- On the other side of the tee, glue in the 10" pipe, and cap it by gluing on a 2" end cap.
- Glue the 2"×¾" slip bushing into the middle of the tee.

Step 4 — Build the valve system.



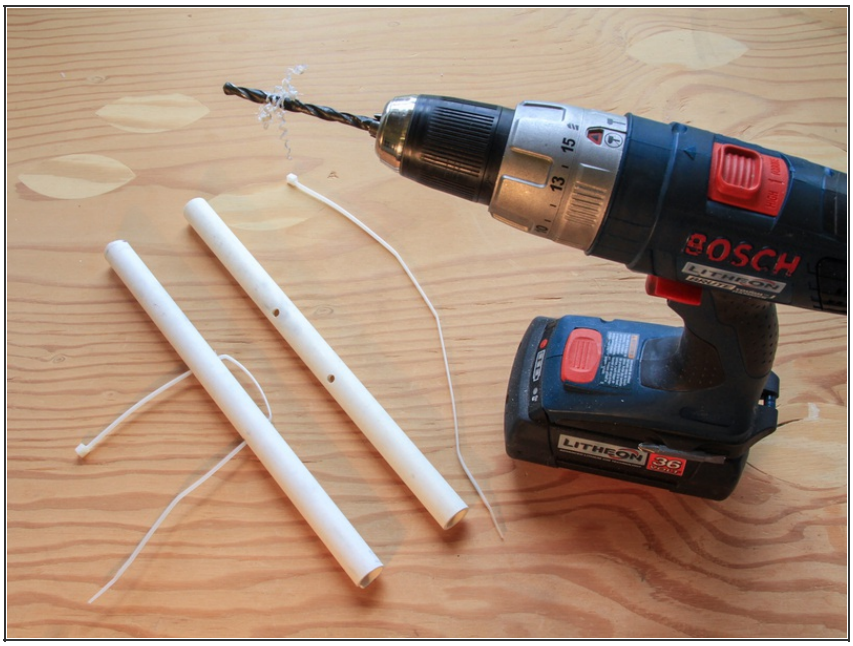
- Wrap teflon tape around the threads of the ¾" MPT (male pipe thread) to ¾" female slip adapters, then screw them into each side of the sprinkler valve and tighten with pliers.
- Note the arrow directions on the valve. On the “in” side, glue in a ¾"×3" pipe. On the “out” side, glue in a ¾"×½" slip reducer and then a ½"×13" pipe, and use a file to bevel the other end of the pipe. (This makes it easier to slip the rockets onto the pipe.)

Step 5 — Connect valve assembly to pressure chamber.



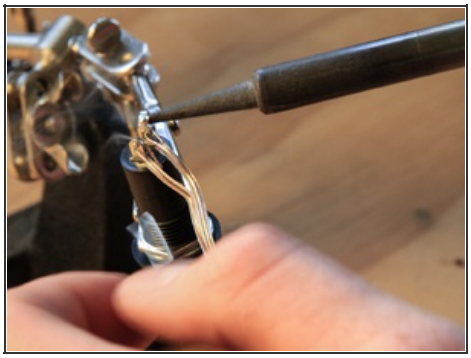
- Glue the “in” side pipe from the valve assembly into the slip bushing in the middle of the pressure chamber tee to connect the 2 assemblies.

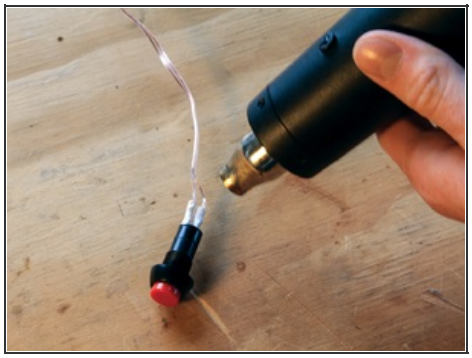
Step 6 — Make the stand tubes.

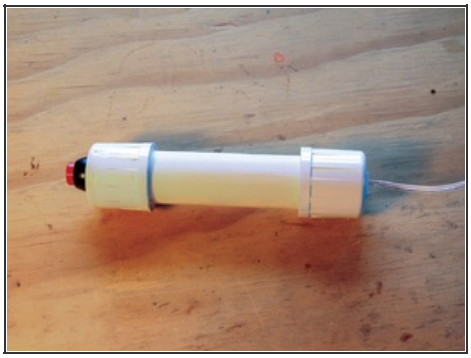


- Drill a pair of ¼" holes completely through each remaining ½"×13" pipe, centered about 2¾" apart.
- Then thread one large zip tie through the holes in each tube, so that the ties can zip around the pressure chamber later.
- Leave the ties open for now.

Step 7 — Make the launch handle.

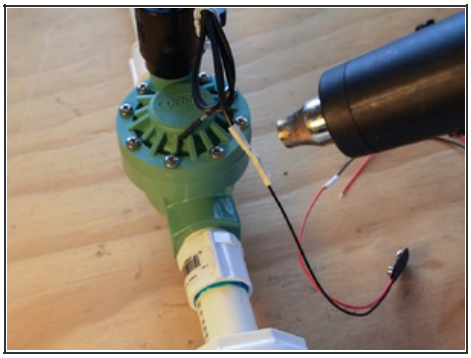
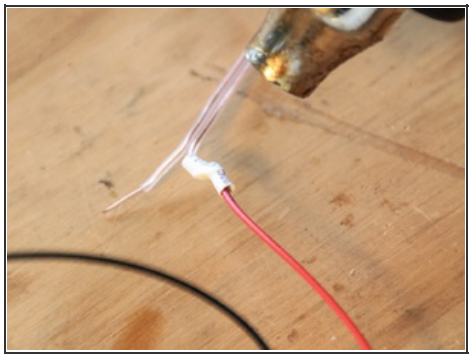
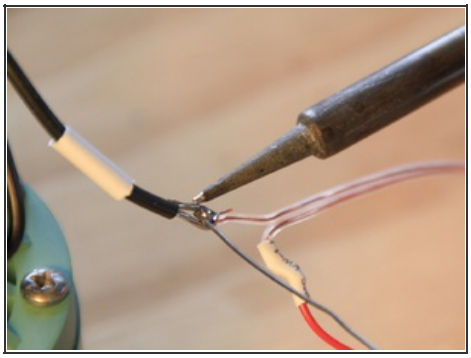






- The launch handle lets you fire rockets from a safe distance.
- Drill a 1/8" hole in one of the ¾" end caps and a ½" hole in the other.
- Solder the pushbutton contacts to the speaker wires, insulate the connections with tape or heat-shrink tubing, and mount the button in the ½" hole, facing out. Tie a loose knot in the wire about 8" from the button.
- Fit this cap over the ¾"x4" pipe, then thread the speaker wire through the other cap and fit it onto the other end, with the knot inside the tube (to prevent pulling on the solder joint). Don't glue the caps, just slip-fit them snugly. A rubber mallet might help.

Step 8 — Connect the power supply.

- Solder the red wire from one battery clip to the black wire of the other clip. Trim the wires for neatness and insulate the connection.
- Solder either free battery wire to either sprinkler valve wire, the remaining battery wire to either speaker wire, and the remaining speaker wire to the remaining sprinkler valve wire.
- Insulate the connections and then load 9V batteries in the snaps. When you press the button now, you should hear the sprinkler valve click.

Step 9 — Connect the air supply.

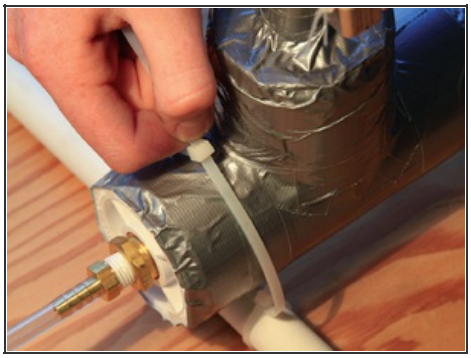


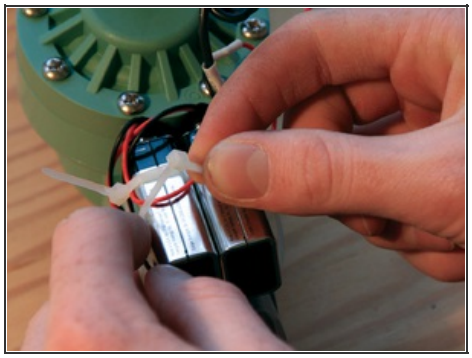
- Use 2 pairs of pliers to twist the rubber sheath off the tire valve, being careful not to crush it.
- Fit the exposed end of the tire valve into one end of the vinyl tube, and secure it with a hose clamp.
- Fit the other end of the tube over the hose barb on the pressure chamber. Secure it with the second hose clamp.

Step 10 — Wrap the pressure chamber.

- Finish up by wrapping the air chamber with several layers of duct tape. This is for safety, to contain any shards of PVC in case the launcher cracks under internal pressure.

Step 11 — Attach the stand tubes and batteries.



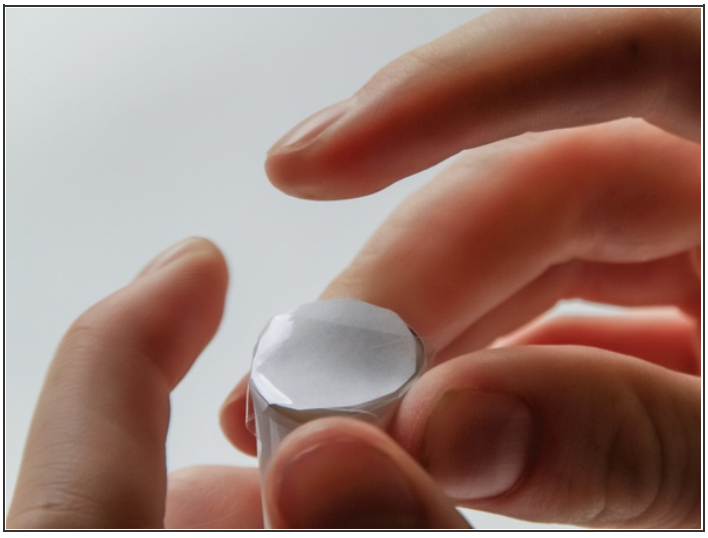


- Finally, tighten the large zip ties on the stand tubes around either end of the pressure chamber.
- Use another large zip tie to attach the batteries to the launcher.
- Your launcher is complete!

Step 12 — Test the system.

- Attach the bike pump to the valve and test the system by pressurizing it to about 75psi. If you find leaks, fix them and try again.

Step 13 — Make the rocket body.

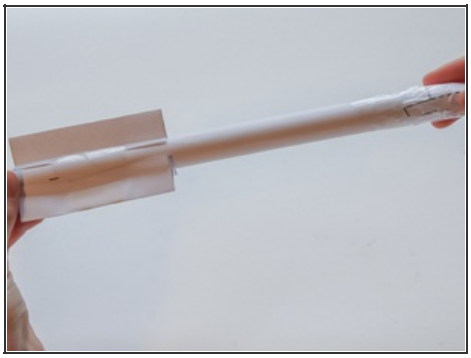


- Download the rocket template from makezine.com/go/rockettemplate and print it on 8½"×14" paper. Cut out the pieces, and decorate if desired.
- Wrap the **body tube** around a 10½" pipe and tape it smoothly in 5 places with ¾" tape. Fully wrap the tube with 2" tape (use clear tape to let any decorations show through), working your way down and making it about 2 layers thick.
- Slide the tube to one end of the pipe and tape the **pressure cap** on by crisscrossing ¾" tape over the top, 2 layers thick, and smoothing it down.

Step 14 — Attach the rocket's nose cone.

- Curl the **nose cone** to overlap the dotted section, tape it together, and use a pencil to pack it tightly with a paper napkin.
- Tape the nose cone on top of the body tube using the tabs, then cover it in tape.

Step 15 — Attach the rocket fins.



- Fold the **fins** on the dashed lines, stack them together, and trim the ends at an angle.
- Wrap the fin guide around the base of the body tube and use it to mark the tube for either 3 or 4 fins.
- Glue the fins together with a glue stick (don’t glue the tabs), line them up at your marked locations, and tape them all securely in place.
- Your rocket is now complete and ready to launch!

Step 16 — Prepare to launch.

- Place the launcher up on a raised surface so the launch tube is above eye level. Lay out the air hose and trigger wire away from the launcher.
- Slide the rocket down the launch tube until it stops at the pressure cap.
- Connect the bike pump to the hose, put on your eye protection, and pump it up to about 75psi. (If you go above 75psi, you may blow out the side of your rocket.)
- CAUTION: Compressed air can be dangerous, so wear eye protection when the launcher is under pressure.

Step 17 — Launch some rockets!

- WARNING: PROJECTILES — Outdoor use only. For makers age 8 and up. Stand back and don't point at people. Launcher is under pressure; don't use if worn or cracked. Be eye and hand safe: use safety goggles and gloves.
- Count down, and then launch your rocket! Standing clear of the pressure chamber, press the launch button.
- With a good launch, the rocket will go nearly out of sight and then free-fall to the ground. The rocket will crumple as it hits the ground, but you can simply pinch it back into shape and launch it again and again.
- If the pressure doesn't release, tighten down the solenoid (the black thing with the wires coming out) on the sprinkler valve. If you're still having problems, most valves have a manual trigger that you can flip to release the pressure.
- CAUTION: If you have to troubleshoot the launcher while it's under pressure, you should wear hearing protection as well, and of course keep your head away from the launch tube.

Rick Schertle (schertle@yahoo.com) is a master of the craft of teaching middle school in San Jose, Calif., and a novice maker at home. His diverse interests include backyard chickens, adventure travel, veggie oil-fueled cars, and geocaching — all made more fun with the enthusiastic support of his wife and the crazy antics of his young son and daughter.

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